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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

TM 001 939

June 1970

U.S. Training and
Employment Service
Technical Report
S-293R

Development of USTES

APTITUDE TEST
BATTERY FOR

ELECTRONIC TECHNICIAN

(profess. & kin.)
003.181

U.S DEPARTMENT OF LABOR
Manpower Administration

Technical Report on Development of USTES Aptitude Test Battery

For . . . .

Electronic Technician (profess. & kin.) 003.181

S-293R

(Developed in Cooperation with the
Wisconsin State Employment Service

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U. S. Department of Labor
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June 1970

FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

GATB Study #2488

Development of USTES Aptitude Test Battery

For

Electronic Technician (profess. & kin.) 003.181-014

S-293R

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Electronic Technician (profess. & kin.) 003.181-014. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
N - Numerical Aptitude	105
S - Spatial Aptitude	100
P - Form Perception	90

Research Summary

Sample:

97 students enrolled in electronics technology at the Milwaukee Institute of Technology.

This study was conducted prior to the requirement of providing minority group information. Therefore, minority group status is unknown.

Criterion:

Grade-point average.

Design:

Longitudinal (test data were collected on first and second year students in 1962 and 1963; criterion data were collected in 1964).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, aptitude-criterion correlations and selective efficiencies.

Predictive Validity:

Phi Coefficient = .39 ($P/2 < .0005$)

Effectiveness of Norms:

Only 67% of the nontest-selected students used for this study were good students; if the students had been test-selected with the above norms, 78% would have been good students. Thirty-three percent of the nontest-selected students used for this study were poor students; if the students had been test-selected with the above norms, only 22% would have been poor students. The effectiveness of the norms is shown graphically in Table 1:

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Students	67%	78%
Poor Students	33%	22%

SAMPLE DESCRIPTION

Size:

N = 97

Occupational Status:

Students.

Work Setting:

Students were enrolled at the Milwaukee Institute of Technology, Milwaukee, Wisconsin.

Institute Selection Requirements:

Education: High school graduation or the equivalent in technical or vocational training including credits for one year of algebra and one year of geometry.

Previous Experience: None required.

Tests: Entrance examination.

Other: None.

Principal Activities:

The job duties for each worker are comparable to those shown in the job description in the Appendix.

Minimum Experience:

None.

TABLE 2

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age and Education.

	Mean	SD	Range	r
Age (years)	22.6	3.8	17-35	.071
Education (years)	13.8	.6	12-15	.234

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002B were administered during the period February 1962 through February 1963.

CRITERION

The criterion was the grade point average for subjects in the fields of Electrical and Mechanical Technology and Mathematics. Grade point averages ranged from 1.28 to 3.90 and had a mean of 2.5 with a standard deviation of .61 (Letter grades of A,B, and C corresponded to quality points of 4.0, 3.0 and 2.0, respectively.)

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 33% of the sample in the low group to correspond with the percentage of students considered unsatisfactory or marginal. Students in the high criterion group were designated as "good students' and those in the low group as "poor students." The criterion critical score is 2.15.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitudes S and P, which do not have high correlations with the criterion, were considered for inclusion in the norms because the qualitative analysis indicated that the aptitudes might be important for the job duties and the sample had relatively high mean scores on these aptitudes. Tables 3, 4, and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performance)

Aptitudes	Rationale
G - General Learning Ability	Required to learn electronic theory and principles and to apply them in order to lay out, build, test and repair electronic equipment.
V - Verbal Aptitude	Required to understand technical information and to prepare technical reports.
N - Numerical Aptitude	Required to calculate unknown quantities using mathematical tables and formulas.
S - Spatial Aptitude	Required to draft and read electrical diagrams and blueprints.
P - Form Perception	Required to observe performance of models and equipment.

TABLE 4

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N=97

	Mean	SD	Range	r
G - General Learning Ability	117.7	9.4	95-139	.502**
V - Verbal Aptitude	107.1	9.5	88-132	.427**
N - Numerical Aptitude	115.1	11.3	94-141	.332**
S - Spatial Aptitude	123.8	13.5	88-153	.034
P - Form Perception	117.0	16.2	81-159	.032
Q - Clerical Perception	113.0	12.6	73-143	.155
K - Motor Coordination	110.5	17.6	68-155	.117
F - Finger Dexterity	110.8	18.2	67-158	.168
M - Manual Dexterity	109.8	20.3	63-159	.097

**Significant at the .01 level.

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes G	V	N	S	P	Q	K	F	M
Job Analysis Data Important	X	X	X	X	X				
Irrelevant									
Relatively High Mean	X			X	X				
Relatively Low Standard Dev.	X	X	X			X			
Significant Correlation With Criterion	X	X	X						
Aptitudes to be Considered for Trial Norms	G	V	N	S	P				

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of the degree to which trial norms consisting of various combinations of aptitudes G, V, N, S and P at trial cutting scores were able to differentiate between the 67% of the sample considered to be good students and the 33% of the sample considered to be poor students. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about one-third of the sample; for two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Norms N-105, S-100 and P-90 provided optimum differentiation for the occupation of Electronic Technician (profess. & kin.) 003.181-014. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .39 (statistically significant at the .0005 level).

TABLE 6

Predicitve Validity of Test Norms
N-105, S-100 and P-90

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Students	8	57	65
Poor Students	16	16	32
Total	24	73	97

Phi Coefficient = .39 Chi Square (X^2_y) = 14.4
Significance Level = P/2 .0005

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study met the requirements for incorporating the occupation studied into OAP-34 which is shown in the 1970 edition of Section II of the Manual for the General Aptitude Test Battery. A Phi Coefficient of .10 is obtained with the OAP-34 norms of N-90, S-95 and P-90.

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FACT SHEET

Job Title

Electronic Technician (profess. & kin.) 003.181-014

Job Summary

Applies electronic theory, principles of electrical circuits, electrical testing procedures, engineering mathematics, physics, and related subjects to lay out, build, test, trouble-shoot, repair and modify developmental and production electronic equipment, such as computers, missile-control instrumentation, and machine tool numerical controls.

Work Performed

Discusses lay out and assembly problems with electronic engineer and draws sketches to clarify design details and functional criteria of electronic units. Assembles experimental circuitry or complete prototype model according to engineering instructions, technical manuals, and knowledge of electronic systems and components and their functions. Recommends changes in circuitry or installation specifications to simplify assembly and maintenance. Sets up standard test apparatus or contrives test equipment and circuitry, and conducts functional, operational, environmental and line tests to evaluate performance and reliability of protype or production model. Analyzes and interprets test data. Adjusts, calibrates, alines, and modifies circuitry and components and records effects on unit performance. Writes technical reports and develops charts, graphs and schematics to describe and illustrate systems operating characteristics, malfunctions, deviations from design specifications, and functional limitations for consideration by professional engineering personnel in broader determinations affecting system design and laboratory procedures. May operate bench lathes, drills and other machine tools to fabricate non-procurable items, such as coils, terminal boards, and chassis. May check out newly installed equipment, airplanes, ships and structures to evaluate system performance under actual operating conditions. May instruct and supervise lower grade technical personnel.

Effectiveness of Norms

Validation Sample

Only 67% of the non-test-selected students used for this study were good students; if the students had been test-selected with the S-293Rnorms, 78% would have been good students. 33% of the non-test-selected students used for this study were poor students; if the students had been test-selected with the S-293Rnorms, only 22% would have been poor students.

Applicability of S-293R Norms

The aptitude test battery is applicable to jobs which include a majority of duties described above.

GPO 898.710

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